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Center for General Health Services Intramural Research

Intermittent Positive Pressure Breathing: Old Technologies Rarely Die

Provider Studies
Research Note

18

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Abstract

The intermittent positive pressure breathing (IPPB) ventilator attained widespread use before its efficacy was established. (IPPB refers both to the ventilator and to treatment using this device.) IPPB was introduced in the mid-1940s, and its use increased steadily until the late 1970s, when mounting evidence against its worth caused its popularity to decline. This Research Note uses the Hospital Cost and Utilization Project database to provide information on the magnitude of the decline in IPPB use from 1980 to 1987. It also provides information on the types of inpatients who received IPPB in 1980 and 1987 and on the types of hospitals that used it. The results indicate that, although use of IPPB declined precipitously during the period, it did not cease completely, and that rates of use and decline varied among types of hospitals. Although the number of inpatients who received IPPB declined, the results also reveal that the distribution across diagnoses of patients on whom it was used remained virtually constant.

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Background

Research Notes are derived from research conducted by staff of the Division of Provider Studies (DPS), Center for General Health Services Intramural Research, Agency for Health Care Policy and Research (AHCPR). This note series provides results of analyses on health policy issues important to the Nation's hospitals.

Overview

The major goal of the Division of Provider Studies, formerly the Hospital Studies Program, is to understand patterns of hospital behavior, use, and costs—particularly how hospitals are affected by changes in health policies and by innovations in the health care industry. The scope of the program covers both national health policy and local issues that influence major segments of the U.S. hospital market. The national and State databases maintained by the Division of Provider Studies can be used for a variety of studies. Some important current issues that can be explored with these data include:

- Effects of major changes in Federal reimbursement policy on hospital behavior, such as numbers of admissions, length of stay, casemix, and profit.
- Results of innovations within the hospital industry, such as the growth of health maintenance organizations and preferred provider organizations, the introduction and diffusion of medical technologies, and the development of hospital alliances.
- Behavioral differences between key groups of hospitals, such as rural and urban, public and private, and teaching and nonteaching.
- Variations in casemix, severity of illness, and medical practice across geographic regions, hospitals, payers, and types of physicians.
- Resource consumption of patients hospitalized for medical conditions of particular policy interest, such as acquired immunodeficiency syndrome (AIDS) and other human immunodeficiency virus (HIV)-related illnesses, Alzheimer's disease, and extreme immaturity among newborns.

The above examples do not exhaust the issues that can be addressed with the databases of the Division of Provider Studies. DPS staff consult with industry experts, public officials, and other researchers in selecting topics for study.

DPS Databases

Three major databases support the research of the Division of Provider Studies: (1) the Hospital Cost and Utilization Project (HCUP), a national sample of more than 500 hospitals; (2) the Hospital Cost and Clinical Research Project (HCCRP), a sample of 46 hospitals that enroll patients in clinical trials under the auspices of the National Cancer Institute (NCI); and (3) the State Hospital Data Project (SHDP), a collection of publicly available discharge data sets for hospitals in California, Florida, Maryland, New York, Massachusetts, Vermont, and Wisconsin. The HCUP hospitals were selected according to stratified sampling procedures and provide the basis for national studies of hospital behavior, utilization, and costs. The HCCRP hospitals were sampled by geographic region and type of NCI clinical-trials program to assess differences in the cost of caring for patients in clinical trials versus patients receiving conventional treatments for cancer. SHDP data were collected by State agencies or data centers from all hospitals within their jurisdictions.

Each project is built around a core of hospital discharge abstracts that provide data on inpatient stays. For HCUP and HCCRP, the abstracts are obtained from discharge abstracting companies or directly from hospitals that have their own in-house data processing systems; participating hospitals supplied all discharge abstracts rather than a sample of records. For SHDP, abstracts are obtained directly from the State agencies or data centers. In addition, each project assembles data on hospitals and local communities from a variety of sources. The American Hospital Association (AHA) has provided data since 1970 from its Annual Survey of Hospitals and various special surveys. All three projects also use county-level statistics obtained from the Area Resource File, compiled by the Health Resources and Services Administration's (HRSA's) Bureau of Health Professions.

Participation in HCUP and HCCRP was voluntary, and about half of sampled hospitals agreed to contribute their data. HCUP data, about 58 million records, cover 1970-77 (HCUP-1) and 1980-87

(HCUP-2). The 5 million HCCRP discharges cover 1980-85. SHDP includes discharges from hospitals in the seven States currently in the project, about 40 million records. Years of data availability vary by State.

For the 1970-77 HCUP-1 sample, financial data were assembled from hospitals' annual Medicare Cost Reports. For the 1980-87 HCUP-2 sample, hospitals authorized release of their financial data from the confidential section of the AHA Annual Survey. The HCUP database also incorporates physician biographical information from the American Medical Association's (AMA's) Masterfile of U.S. Physicians, thus permitting a unique linkage among inpatient records, hospital data, and physician characteristics for about 160 hospitals.

The HCCRP database combines information on patients placed on protocols for new cancer treatments with discharge abstract data so that differences in charges for protocol and nonprotocol patients can be determined and analyzed. Twenty-five data processing centers provided these protocol data sets for the National Cancer Institute.

The databases of the Division of Provider Studies allow a variety of studies to be conducted both across types of hospitals and across time. Studies national in scope require the HCUP data. State data can be used to study small-area variations and the hospital market. These databases, augmented by the latest available information, permit comprehensive assessment of factors affecting patterns of hospital use and costs.

Acknowledgments

Financial support for the Division of Provider Studies has been provided by the Office of the Assistant Secretary for Health, the Office of the Assistant Secretary for Planning and Evaluation, the National Institutes of Health, and the Health Care Financing Administration (HCFA).

AHCPR contracting arrangements and data confidentiality safeguards preclude the identification of individual hospitals, physicians, or their patients. The Division of Provider Studies cannot acknowledge individually the contributions they have made to this research; but without such cooperation, the empirical research published by DPS since 1982 would not have been possible.

AHCPR thanks the following discharge abstracting companies for their timely contributions: Commission on Professional and Hospital Activities, Ann Arbor, MI; McDonnell Douglas Health Information Systems Co., Hazelwood, MO; Health Data Service of Maryland (a subsidiary of Blue Cross and Blue Shield of Maryland), Towson, MD; ServiShare of Iowa, Des Moines, IA; Hospital Utilization Project, Monroeville, PA; Quadax, Inc., Cleveland, OH; Utilization Information Service/Massachusetts Hospital Association, Burlington, MA; Utilization Information Service/Hospital Association of New York State, Albany, NY; Hospital Industry Data Institute, Jefferson City, MO; Shared Medical Systems, Malvern, PA; Commonwealth Clinical Systems, Charlottesville, VA; Infomed Associates, Inc./Rochester Area Hospitals Corp., Rochester, NY; MicroDecision Systems at the Center for Health Affairs, Princeton, NJ; MEDIX/Blue Cross of New Jersey, Florham Park, NJ; Kansas Health Data System/Blue Cross and Blue Shield of Kansas, Topeka, KS; and CHIP of Georgia/Blue Cross and Blue Shield of Georgia, Columbus, GA. In every case, these organizations released discharge abstract data only with the written authorization of the hospitals in the HCUP and HCCRP samples. To protect the confidentiality of participating hospitals, data were sent directly to a data processing contractor. All identifying information was removed from files prior to their receipt by AHCPR. In all cases, data were provided with the understanding that analyses, interpretations, and conclusions would be the sole responsibility of AHCPR.

AHCPR also acknowledges the generous provision of discharge abstract data from State agencies and/or their data processing centers, including the California Office of Statewide Health Planning and Development, Sacramento, CA; the Florida Health Care Cost Containment Board, Tallahassee, FL; the Maryland Health Services Cost Review Commission and the Information Service Center, Baltimore, MD; the New York State Department of Health, Statewide Planning and Research Cooperative System Bureau, Albany, NY; the Massachusetts Health Data Consortium, Inc., Waltham, MA; the State of Vermont, Agency of Human Services, Waterbury, VT; and the Wisconsin Office of Health Care Information, Madison, WI.

In addition to the extensive AHA and AMA data contributions discussed above, other hospital or program files were provided by the Office of Research and the Health Standards and Quality Bureau, HCFA; the Bureau of Health Professions, HRSA; the Association of American Medical Colleges; Abt Associates, Inc.; and the United Hospital Fund.

Several organizations generously shared with DPS the software they developed. They include SysteMetrics, Inc.; Health Systems International; the Health Care Research Department, Blue Cross of Western Pennsylvania; the Commission on Professional and Hospital Activities; the Institute for Health Policy Studies, University of California at San Francisco; and the School of Organization and Management, Yale University.

Data files for HCUP and HCCRP were constructed under the technical direction of AHCPR by SysteMetrics, Inc., Santa Barbara, CA. Data file construction for SHDP and programming support for DPS researchers are provided by Social and Scientific Systems, Inc., Bethesda, MD.

The authors would like to thank Rosanna Coffey, Ph.D., and Bernard Friedman, Ph.D., for advice and encouragement and to thank Sandy Smoot of Social and Scientific Systems for expert computing support.

Additional information on the Division of Provider Studies and its databases is available from the Division of Provider Studies, AHCPR, 2101 East Jefferson Street, Suite 500, Rockville, MD 20852; phone (301) 594-1410.

Copies of Division of Provider Studies publications are available from the AHCPR Publications Clearinghouse, P.O. Box 8547, Silver Spring, MD 20907; phone toll free 800-358-9295.

Contents

Intermittent Positive Pressure Breathing: Old Technologies Rarely Die

Sarah Q. Duffy, Ph.D., and Dean E. Farley, Ph.D., Agency for Health Care Policy and Research

Introduction

The United States is ambivalent when it comes to medical technology. On the one hand, development and availability of technologies are often cited as one of the major successes of our health care system. The United States is compared favorably with other countries because of the relatively greater per capita availability of open heart surgery services, computed tomography scanners, and other medical technologies (*The President's Comprehensive Health Reform Program,* 1992; Iglehart, 1986; Relman, 1986). Reform proposals often caution against making changes in health care delivery and finance that would limit the development of new technologies or reduce access to existing technologies (*The President's Comprehensive Health Reform Program,* 1992; Pauly et al., 1991; Enthoven and Kronick, 1989). To do so, the authors of these proposals warn, would decrease the quality of medical care to a level below that we currently enjoy.

On the other hand, there has long been concern that the development and diffusion of medical technology beyond appropriate levels have contributed significantly to health care costs (Pauly, 1988; Goddeeris, 1984; Cromwell and Kanak, 1982; Russell, 1979; Lee, 1971). There is also the belief that some technologies being used in medical practice are ineffective and perhaps even dangerous because they were introduced before they were adequately tested (Hughes, 1980; Enthoven, 1980; Willems et al., 1979). Innovations in medical technology have not been subject to the same rules and regulations as innovations in drug therapies. Although drugs have been extensively tested for safety since 1938 and for efficacy since 1962 (Feldstein, 1988), it was not until 1976 that the Medical Devices Amendment to the Food, Drug, and Cosmetics Act gave the Food and Drug Administration (FDA) the authority to evaluate the safety and effectiveness of new devices (Willems et al., 1979).[1]

Prior to 1976, medical devices could be introduced by any manufacturer without review by an impartial authority. Such devices could diffuse rapidly and be used on countless patients before ever being subjected to safety or efficacy tests. Perhaps even more disconcerting, these devices often continued to be used in spite of mounting evidence that they were unsafe or ineffective.

The intermittent positive pressure breathing (IPPB) ventilator is one such device. (IPPB refers both to the ventilator and to treatment using this device.) This pressure-cycled respirator was developed during World War II to help high-altitude pilots breathe in unpressurized cabins (Handelsman, 1991; McGlynn and Kahan, 1985). Physicians soon began to explore its uses to treat patients with chronic obstructive pulmonary disease (COPD) and other respiratory conditions and to prevent and treat postoperative atelectasis.[2] Use of IPPB spread quickly in spite of several studies questioning its efficacy (Pontoppidan, 1980). By 1977 it had become one of the most common procedures performed in respiratory therapy departments (Rau and Rau, 1977). It was not until 1983 that the results were published from a randomized clinical trial supported by the National Heart, Lung, and Blood Institute comparing IPPB with the compressor nebulizer. The results confirmed that IPPB was no better than the less costly and less dangerous nebulizer for treating stable COPD patients in an outpatient setting. In 1991, the Office of Health

[1] Even the 1976 medical device regulations are considered lax when compared with drug regulations (Willems et al., 1979; McKay, 1986). The Safe Medical Devices Act of 1990, the final version of which has recently become law, should make available more information about the safety of medical devices. It requires users, importers, and distributors to report any deaths, serious injuries, or serious illnesses related to certain classes of medical devices to the FDA and the device manufacturer.

[2] For a more detailed description of IPPB see Handelsman, 1991; Duffy and Farley, 1992.

Technology Assessment (OHTA) of the Agency for Health Care Policy and Research, which is charged with making recommendations on the coverage of specific medical devices for Federal health programs, conducted an assessment of IPPB (Handelsman, 1991). That assessment concluded that, although IPPB may be useful in certain rare circumstances, it is generally not helpful in treating COPD or in preventing postoperative atelectasis, its two primary applications. The literature reviewed for the OHTA report does not rule out the use of IPPB as a last resort when other respiratory therapies are ineffective. However, the fact that IPPB was not completely discredited is based not on scientific evidence that it works but rather on the lack of evidence that it does not work in certain cases. It is interesting to note that the most recent study cited in the OHTA report was from 1986 and that the report relies mostly on information published in the late 1970s to mid-1980s.

Although IPPB continues to be administered, its use has declined substantially. Using the Hospital Cost and Utilization Project database, this Research Note provides information on the magnitude of the decline in use of IPPB from 1980 to 1987. It also provides information on the types of inpatients who received IPPB in 1980 and 1987 and on the types of hospitals that used it in those years. The results indicate that, although use of IPPB declined precipitously during the period, it did not cease completely, and rates of use and decline varied among different types of hospitals. Although the number of inpatients who received IPPB declined, the results also reveal that the distribution of patients across the diagnoses it was used to treat remained virtually constant.

Data and Methods

Information on use of IPPB is drawn from a subsample of the 1980-87 Hospital Cost and Utilization Project (HCUP-2) database maintained by the Agency for Health Care Policy and Research (Coffey and Farley, 1988). The database contains detailed information on discharges and hospital characteristics for more than 400 hospitals nationwide from 1980 to 1987. The subsample used for this Research Note includes discharges from the 334 hospitals that provided information for the full 8 years. Table 1 compares selected hospital characteristics in 1980 for the 334 hospitals in the study sample with

Table 1
Characteristics of hospitals in the AHA universe and the HCUP-2 sample: 1980

Hospital characteristic	AHA (N = 5,798)	Study sample (N = 334)
Mean number of beds	170	228
	Percent	
Has approved residency program, affiliation with a medical school, or membership in the Council of Teaching Hospitals	15	29
Has respiratory therapy services	30	36
Located in SMSA	51	55
Region	Percent distribution	
Northeast	15	26
North Central	29	35
South	37	21
West	19	18
Control		
Local government	31	29
Voluntary	56	67
Investor-owned	13	4

Note: AHA is American Hospital Association. HCUP-2 is 1980-87 Hospital Cost and Utilization Project. SMSA is standard metropolitan statistical area.

Sources: Agency for Health Care Policy and Research, Center for General Health Services Intramural Research, Division of Provider Studies: Data from the Hospital Cost and Utilization Project, 1980-87, and the American Hospital Association, 1980 Survey.

those for the American Hospital Association universe of short-term, general, non-Federal hospitals. The HCUP-2 sample underrepresents smaller hospitals, investor-owned hospitals, and those located in the South. It overrepresents teaching hospitals and those with respiratory therapy departments.

Discharges included in the analysis had the *International Classification of Diseases, 9th Revision, Clinical Modification* (ICD-9-CM) (Public Health Service and Health Care Financing Administration, 1980) code for IPPB, 93.91, recorded as the primary or any other listed procedure.[3] Discharges were categorized hierarchically by whether they had the following as the principal or any other listed diagnosis:

- COPD.
- Other respiratory conditions.
- Cardiovascular disease.
- Any other diagnosis.

The ICD-9-CM codes used to define the COPD category are displayed in Table 2. All discharges with any of those codes as a listed diagnosis were assigned to the COPD category. All remaining discharges with any non-COPD diagnosis code classified as a disease of the respiratory system by the ICD-9-CM disease classification system (codes 460-519.9) were assigned to the "other respiratory" category. All other discharges with any diagnosis code from 390 through 459.9 were assigned to the cardiovascular category. (Cardiovascular discharges were separated from others because they comprised a large proportion of the nonrespiratory discharges that received IPPB.) The remaining discharges, those with none of the above codes anywhere in their record, were assigned to the "other" category. In addition to classification by diagnosis, discharges with surgical diagnosis-related groups (DRGs) were identified to determine the magnitude of use of IPPB on surgical inpatients.

Discharges With IPPB

The distributions of IPPB discharges by diagnosis category in 1980 and 1987 are displayed in Figure 1. The figure shows that although the number of discharges with IPPB dropped by more than 88 percent, the distribution across discharge categories changed very little. In both periods, COPD and other respiratory discharges accounted for about 50 percent of all IPPB discharges.

Discharges were also classified by whether they had been assigned to a surgical DRG. Figure 2

Table 2
Diagnoses used to select patients with COPD

ICD-9-CM diagnosis code	Description
415.0[1]	Acute cor pulmonale
416.0[1]	Primary pulmonary hypertension
416.8[1]	Other chronic pulmonary heart disease
416.9[1]	Chronic pulmonary heart disease, not otherwise specified
490[1]	Bronchitis not specified as acute or chronic
491.0[1]	Simple chronic bronchitis
491.1	Mucopurulent chronic bronchitis
491.2	Obstructive chronic bronchitis
491.8	Other chronic bronchitis
491.9	Unspecified chronic bronchitis
492.0	Emphysematous bleb
492.8	Other emphysema
494[2]	Bronchiectasis
496	Chronic airway obstruction
506.0[1]	Bronchitis and pneumonitis due to fumes and vapors
506.4	Chronic respiratory conditions due to fumes and vapors
506.9[2]	Unspecified respiratory conditions due to fumes and vapors
508.8[1]	Respiratory conditions due to other specified external agents
518.1[1]	Interstitial emphysema
518.2[1]	Compensatory emphysema
748.61[2]	Congenital bronchiectasis

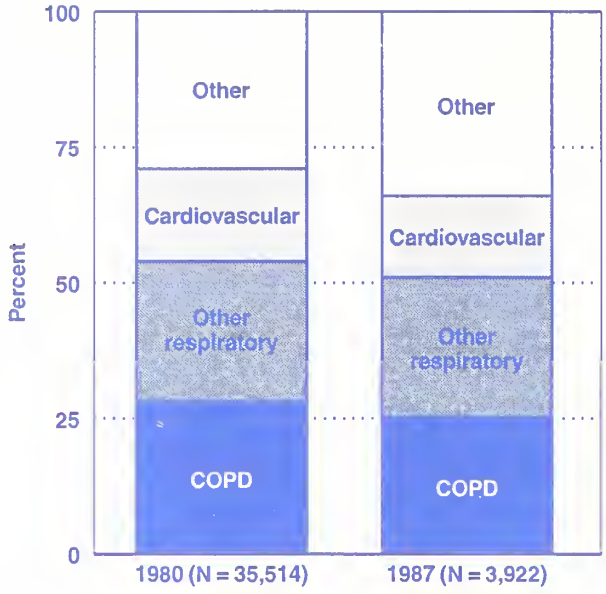
[1] Diagnosis is included in the definition of DRG 88 (COPD) but not in the COPD disease category of Disease Staging (Gonnella, 1985).
[2] Diagnosis is not in the definition of DRG 88 but is included in the COPD disease category of Disease Staging (Gonnella, 1985).

Note: COPD is chronic obstructive pulmonary disease. DRG is diagnosis-related group.

Source: *International Classification of Diseases, 9th Revision, Clinical Modification,* 1980.

[3] Discharge records included in the sample have space for a minimum of four procedure codes. It is possible that IPPB may not be coded if a discharge has more than four procedures or for other reasons. Hence, it is possible that HCUP-2 counts of IPPB use may understate true use.

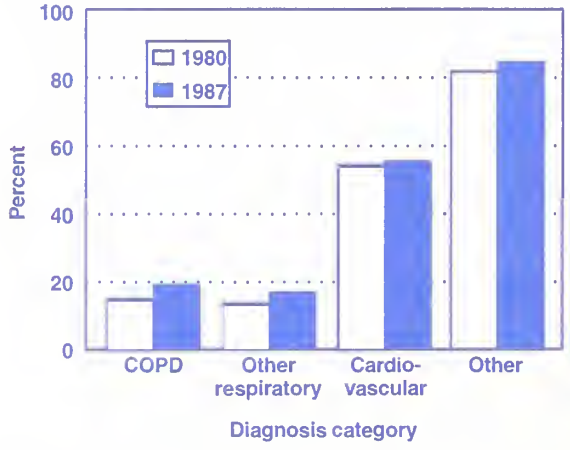
Figure 1
Percent distribution of discharges with IPPB treatment, by diagnosis category: 1980 and 1987



Note: IPPB is intermittent positive pressure breathing. COPD is chronic obstructive pulmonary disease.

Source: Agency for Health Care Policy and Research, Center for General Health Services Intramural Research, Division of Provider Studies: Data from the Hospital Cost and Utilization Project, 1980-87.

Figure 2
Percent of IPPB discharges with surgical DRGs, by diagnosis category: 1980 and 1987



Note: IPPB is intermittent positive pressure breathing. DRGs are diagnosis-related groups. COPD is chronic obstructive pulmonary disease.

Source: Agency for Health Care Policy and Research, Center for General Health Services Intramural Research, Division of Provider Studies: Data from the Hospital Cost and Utilization Project, 1980-87.

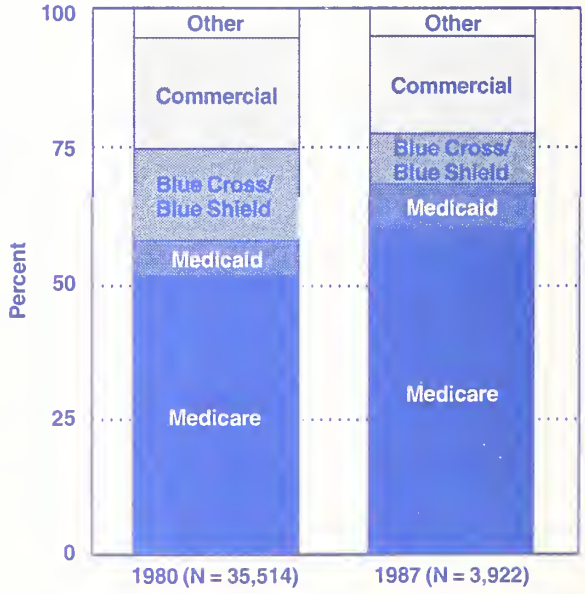
shows that the percentage of discharges in each diagnosis category assigned to a surgical DRG increased slightly from 1980 to 1987. It also shows that surgical discharges make up most of the discharges assigned to the "other" category in each year.

Figure 3 displays the distribution of discharges by expected primary source of payment. It reveals that in both 1980 and 1987, the majority of IPPB treatments were paid for by State and Federal Governments. About 55 percent of all IPPB discharges in 1980 had either Medicare or Medicaid as a source of payment, a proportion that increased to more than 65 percent in 1987. Medicare cases accounted for most of this increase.

Hospitals Using IPPB

The percent of hospitals that had IPPB "in place" declined from about 55 percent of the sample in 1980 to 25 percent in 1987, as shown in Figure 4. Hospitals are said to have IPPB in place

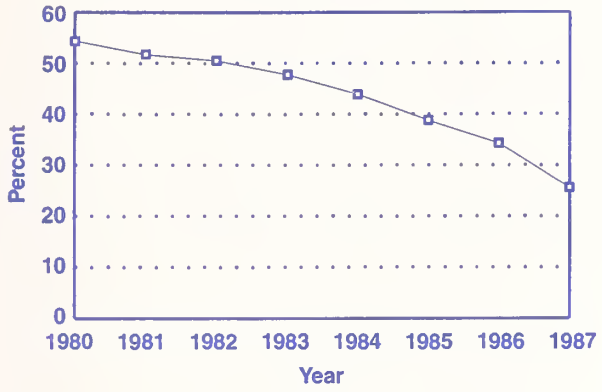
Figure 3
Percent distribution of patients with IPPB treatment, by expected primary source of payment: 1980 and 1987



Note: IPPB is intermittent positive pressure breathing.

Source: Agency for Health Care Policy and Research, Center for General Health Services Intramural Research, Division of Provider Studies: Data from the Hospital Cost and Utilization Project, 1980-87.

Figure 4
Percent of hospitals with IPPB in place:[1] 1980-87

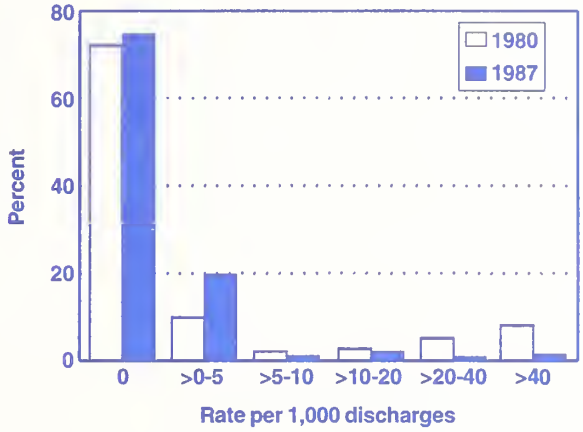


[1] Hospitals are said to have IPPB in place in a given year if they used it in that year or in any subsequent year.

Note: IPPB is intermittent positive pressure breathing.

Source: Agency for Health Care Policy and Research, Center for General Health Services Intramural Research, Division of Provider Studies: Data from the Hospital Cost and Utilization Project, 1980-87.

Figure 5
Percent distribution of sample hospitals, by rate of use of IPPB per 1,000 total discharges: 1980 and 1987



Note: IPPB is intermittent positive pressure breathing.

Source: Agency for Health Care Policy and Research, Center for General Health Services Intramural Research, Division of Provider Studies: Data from the Hospital Cost and Utilization Project, 1980-87.

in a given year if they used it in that year or in any subsequent year.[4]

Although 55 percent of the hospitals in the sample had IPPB in place in 1980, Figure 5 reveals that only about one-half of those, or 28 percent of the total sample, used the procedure that year. This suggests that IPPB is used infrequently in many hospitals and that its use varies considerably from year to year. Figure 5 also shows that the percentage of hospitals that did not perform IPPB on any of their inpatients in a given year increased only slightly from 1980 to 1987, from about 72 percent to about 75 percent of the sample.

Table 3 displays rates of use of IPPB per 1,000 total discharges, COPD discharges, and surgical discharges for all hospitals in the sample in 1980 and 1987. (The focus is narrowed to these three discharge categories to simplify the table. COPD and surgery are the primary indications for IPPB.) Rates of use were highest for COPD discharges in both years. Rates of use declined significantly for all uses from 1980 to 1987.

Table 3 also provides rates of use of IPPB and the *p*-values of the differences for these selected hospital characteristics:

- Teaching status.
- Number of beds.
- Region.
- Location.
- Control.

In 1980, the difference in rates of use between teaching hospitals and nonteaching hospitals was not significant for total discharges, COPD discharges, or surgical discharges. However, although both types of hospitals had significantly reduced their use of IPPB by 1987, teaching hospitals used it significantly less frequently than did nonteaching hospitals.

Although considerable variation exists in average use rates across hospital-size categories (as measured by number of beds), the differences are not statistically significant in either year. The table also reveals that rates of decline over time by size category were not universally significant.

[4] As the last year of the sample is 1987 and a hospital is defined as having IPPB in place in a given year if it had an inpatient discharge record with IPPB coded in that year or any subsequent year, it is possible that the percentage of hospitals with IPPB in place in 1987 is underestimated. In fact, it is possible that recorded use of IPPB from 1983 onward calculated from discharge abstract records is lower than actual IPPB use. The introduction of DRGs and other changes in payment policy removed much of the financial incentive to code IPPB specifically on inpatient discharge records, particularly those of Medicare patients, and increased quality review activities generated incentives not to code it. However, as there was clearly a downward trend in use of IPPB before any of these changes took place, undercounting is likely to be minor.

Table 3
Rates of use of IPPB per 1,000 total discharges, COPD discharges, and surgical discharges, by selected hospital characteristics: 1980 and 1987

Characteristic	Rate per 1,000 total discharges			Rate per 1,000 COPD discharges			Rate per 1,000 surgical discharges		
	1980	1987	*p*-value of difference between years	1980	1987	*p*-value of difference between years	1980	1987	*p*-value of difference between years
All hospitals (N = 334)	6.8	1.96	0.0001	44.35	8.01	0.0001	7.79	1.1	0.0001
Teaching status									
Teaching (N = 95)	4.59	0.46	0.0018	32.23	2.52	0.0007	5.56	0.48	0.0059
Nonteaching (N = 239)	7.68	2.56	0.0006	49.14	10.02	0.0001	8.68	2.90	0.0019
p-value of difference by teaching status	0.0922	0.0176	—	0.1466	0.0245	—	0.2132	0.0165	—
Number of beds									
0-49 (N = 47)	7.69	0.86	0.0022	61.79	3.38	0.0019	6.72	2.46	0.0754
50-99 (N = 78)	6.80	2.61	0.1553	36.42	7.79	0.0182	7.24	2.05	0.1222
100-199 (N = 66)	7.20	2.95	0.1126	43.79	12.48	0.0439	9.81	2.64	0.0533
200-299 (N = 47)	4.43	3.28	0.7198	29.24	14.51	0.3809	4.53	4.57	0.9931
300 or more (N = 96)	7.25	0.66	0.0001	50.04	4.19	0.0001	8.96	0.78	0.0003
p-value of difference by number of beds	0.9027	0.5335	—	0.5941	0.5288	—	0.7874	0.5866	—
Region									
North Central (N = 117)	8.56	0.67	0.0001	56.32	2.88	0.0001	10.74	1.22	0.0002
Northeast (N = 84)	3.41	0.27	0.0085	22.65	2.12	0.0087	3.11	0.30	0.0120
South (N = 72)	7.24	3.03	0.1702	40.49	14.72	0.0891	8.54	4.36	0.3054
West (N = 61)	7.57	5.52	0.5667	55.84	18.03	0.0529	7.67	4.22	0.3286
p-value of difference by region	0.2220	0.0165	—	0.1340	0.0342	—	0.1594	0.1103	—
Location									
Urban (N = 185)	4.954	2.01	0.0267	33.10	6.95	0.0002	5.51	1.82	0.0083
Rural (N = 149)	9.098	1.92	0.0002	58.32	9.31	0.0001	10.62	2.70	0.0033
p-value of difference by location	0.0431	0.9330	—	0.0429	0.6272	—	0.065	0.5666	—
Control									
Local government (N = 97)	8.97	1.94	0.0067	55.85	7.96	0.0012	10.39	3.02	0.0356
Voluntary (N = 225)	5.79	1.48	0.0001	39.12	7.28	0.0001	6.79	1.62	0.0003
Investor-owned (N = 12)	8.33	11.10	0.8370	51.56	21.96	0.5117	5.42	6.85	0.8699
p-value of difference by control	0.3205	0.0153	—	0.4482	0.5056	—	0.4333	0.3020	—

Note: IPPB is intermittent positive pressure breathing. COPD is chronic obstructive pulmonary disease.

Source: Agency for Health Care Policy and Research, Center for General Health Services Intramural Research, Division of Provider Studies: Data from the Hospital Cost and Utilization Project, 1980-87.

Only hospitals with 300 or more beds had significant declines in all discharge categories.

Rates of use did not differ significantly by region for any discharge category in 1980. However, by 1987 IPPB was used relatively more frequently in the South and West for total discharges and for COPD discharges than in the Northeast and North Central Regions. Although rates of use declined significantly in the two northern regions between the two years, the declines were not significant in the South or West.

Urban hospitals were significantly less likely to use IPPB on total discharges and on COPD discharges than were rural hospitals in 1980. By 1987, the difference had become insignificant. Hospitals in both locations reduced usage significantly during the time period.

Table 3 reveals that differences in use by control were not significant in 1980. It appears that by 1987 local government and voluntary hospitals had reduced use of IPPB more than had investor-owned hospitals, although, again, such conclusions must be drawn with caution. Analyses run excluding investor-owned hospitals reveal no significant differences by control. These results should not be considered conclusive because of the poor representation in HCUP-2 of investor-owned hospitals.

Comments

The consensus in the medical literature is that IPPB is ineffective for most indications and is potentially dangerous. It is expensive as well, not only because of its direct costs, which are higher than those of alternative treatments, but also because of the complications it can cause (Gonzalez and Burke, 1984; Russell, 1979; Morrison, Powers, and Boocks, 1976). As early as 1980, there were several articles in medical journals suggesting that the use of IPPB be discontinued or severely curtailed (Schilling and Kasik, 1980; The Respiratory Care Committee of the American Thoracic Society, 1979; Hudson, 1978; Dutton, Browner, and Powers, 1979; Gold, 1976). Also, the results of a National Heart, Lung, and Blood Institute randomized clinical trial, which should have ended the use of IPPB therapy on stable COPD outpatients, were published in 1983 (Intermittent Positive Pressure Breathing Trial Group, 1983). Still, data from the Health Care Financing Administration's Information Analysis Data Line indicate that approximately 60,000 Medicare outpatients received IPPB as late as 1989. Estimates from the HCUP-2 database indicate that more than 61,000 discharge abstracts nationwide reported IPPB treatments as late as 1987, with the Federal Government picking up most of the tab. Hospital-level analyses reveal that there continue to be variations in rates of use across types of hospitals, most notably by teaching status and regional location.

Why would physicians continue to order IPPB? Although the HCUP-2 data do not allow empirical analysis of physician motives, the literature suggests a few possibilities. One is habit. Physicians learned to prescribe IPPB in medical school and never stopped (Gold, 1976).

Another reason physicians may continue to prescribe IPPB is that it has traditionally been indicated for two conditions, COPD and postoperative atelectasis, that are frustrating for the physician and devastating for the patient. COPD is in many cases irreversible and becomes progressively worse in spite of treatment. Physicians may continue to order IPPB if it relieves the patient's symptoms, even for only a short while. Respiratory complications such as postoperative atelectasis are a major concern after abdominal and thoracic surgery. They are the most frequent cause of postoperative morbidity and mortality, affecting from 20 to 40 percent of surgical discharges (Davies, MacLeod, and Ogilvie, 1990; Pontoppidan, 1980; Jung et al., 1980). Physicians may be convinced from their own clinical experience that IPPB can prevent or treat atelectasis better than other methods, regardless of findings to the contrary in the medical literature.

Another reason is financial. Although IPPB is ordered by the attending physician, it is provided by the respiratory therapy department and performed at the patient's bedside, usually by respiratory technicians or therapists. To be accredited by the Joint Commission on Accreditation of Healthcare Organizations, the respiratory therapy department must have a medical director, often an anesthesiologist or pulmonary specialist. In many hospitals the medical director receives a percentage of the department's income and may also be the "primary source of orders for services to be rendered by the department" (Goldberg and DeNoble, 1986).

Although use of IPPB has declined considerably in the past decade, it has not ceased. In fact, the HCUP-2 database indicates that IPPB has been used to treat some hospitalized patients with acquired immunodeficiency syndrome. Although the number of patients may have been fewer than 100 nationwide in 1987, the latest year for which discharge data are available, these figures demonstrate that physicians continue to find new applications for IPPB despite years of controversy and an absence of scientific evidence of its efficacy.

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Provider Studies Research Notes

No.	Title (Author) and Order Number	Date
1	Project Overview (Hornbrook) NTIS Accession No. PB84-111566	June 1983
2	Patients in Public General Hospitals: Who Pays, How Sick? (Coffey) PHS Pub. No. 83-3344	Sept. 1983
3	Characteristics of Financially Distressed Hospitals (Kelly and O'Brien) NTIS Accession No. PB84-111574	June 1983
4	Who Receives Cesareans: Patient and Hospital Characteristics (Goldfarb) NTIS Accession No. PB85-124766	Sept. 1984
5	Sole Community Hospitals: Are They Different? (Farley) PHS Pub. No. 85-3348	Mar. 1985
6	Utilization of Hospital Inpatient Services by Elderly Americans (Garnick and Short) PHS Pub. No. 85-3351	June 1985
7	Competition Among Hospitals: Market Structure and Its Relation to Utilization, Costs, and Financial Position (Farley) PHS Pub. No. 85-3353	Aug. 1985
8	Use of Short-Term General Hospitals by Patients With Psychiatric Diagnoses (Wallen) PHS Pub. No. 86-3395	Oct. 1985
9	Case Mix and Treatment Patterns of Medicaid and Privately Insured Psychiatric Patients in Short-Term General Hospitals (Wallen) PHS Pub. No. 87-3402	Oct. 1986
10	HCUP-2 Project Overview (Coffey and Farley) PHS Pub. No. 88-3428	July 1988
11	Trends in Hospital Average Lengths of Stay, Casemix, and Discharge Rates, 1980-85 (Farley) PHS Pub. No. 88-3420	Apr. 1988
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